WORKING paper

Regional Income Distributions in France, 1960–2018

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ABSTRACT

This paper proposes homogeneous annual series on the income distribution of French metropolitan départements for the period 1960-69 and 1986-2018. We rely on unpublished and newly digitised archives of the French Ministry of Finance. They consist of fiscal tabulations that are a summary of households' income tax declarations. Based on these raw sources, we interpolate the whole income distribution of French metropolitan départements after 1986. Before 1986, we need more assumptions as only households liable to French income tax filed income tax declarations at that time. We propose a methodology to estimate the number and average income of non-taxable households before 1986 that also allows us to reconstruct the income distribution of French metropolitan départements for the period 1960-69[3].

Keywords: Intraregional Inequalities, Income Distribution, Economic Geography, Economic History

JEL classification: D30, N34, N94, R12

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NON-TECHNICAL SUMMARY

The question of spatial inequalities has garnered increasing interest. However, in most countries, the extent of regional disparities remains unknown. For example, in France, there are numerous debates on the existence of a territorial divide between the Paris region and the rest of France.

In this paper, we uncover the magnitude of regional income disparities in France since 1960. More specifically, we construct homogeneous income distribution series for French metropolitan départements (hereafter referred to simply as departments) for the period 1960-69 and 1986 onwards. First, we have uncovered and digitised more than 4,500 unexplored fiscal archives from the French Ministry of Finance. Then, we have developed a methodology to reconstruct the income distribution of each French department.

Our work contributes to the literature on spatial inequality. Up until recently, the literature on economic history and spatial inequality has used indirect and scarce measures of long-term local standards of living. Many articles have relied on regional value added data, which are easier to reconstruct on the long run. However, Bonnet et al (2021) have reconstructed average income of French departments since 1922 and shown that income spatial inequality may strongly differ from value added spatial inequality because of the monetary transfers (such as transfers due to the retirement or the unemployment system) that take place between regions.

Furthermore, until recently, most of the literature on spatial inequality has used data on average income per geographical unit. Few recent works on US data provide a deeper understanding of spatial inequality by using local income distribution series. Similarly, we find mixed results in France: the average income of the poorest tax units of each department have converged, it lead to a very significant reduction in interdepartmental average income inequality in the last fifty years, and concealed the divergence of the average income of the richest tax units of some departments.

Comparison of the average income of top 1% tax units of each department and metropolitan France
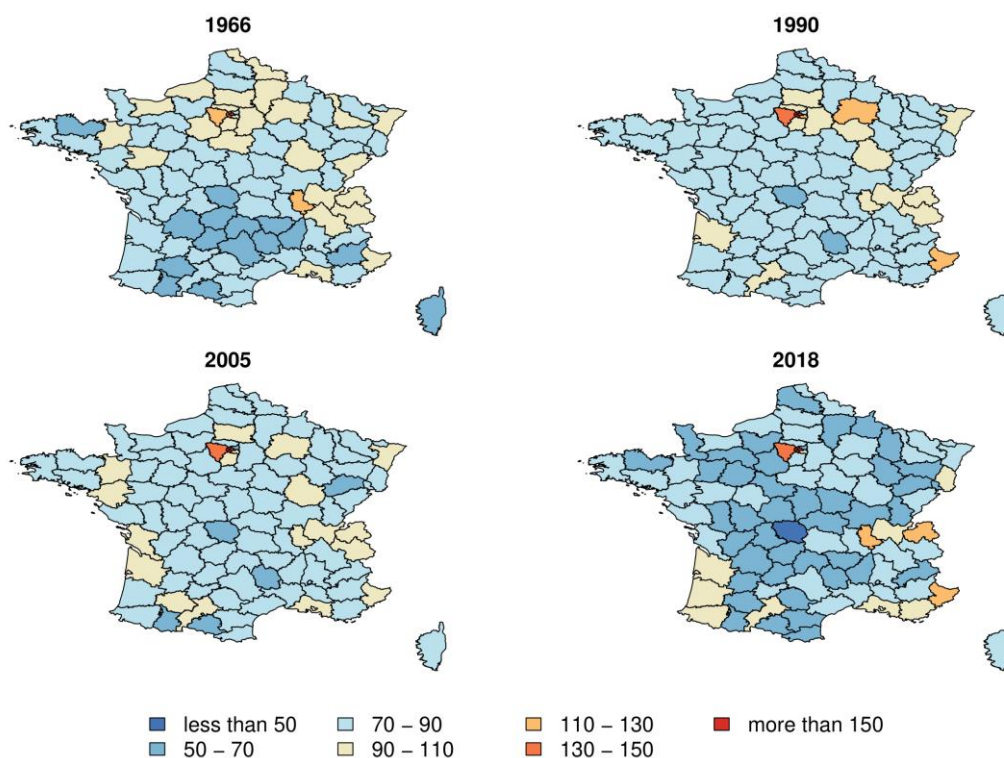
Note: We define the average income of top 1% tax units of a department (respectively France) as the average fiscal income of the 1% richest tax units in a department (respectively France). We represent the ratio of these two quantities. A dark blue colour means the top 1% tax units of a department have, on average, a fiscal income 50% smaller than the average income of the national top 1% tax units. A dark red colour means the top 1% tax units of a department have, on average, a fiscal income 50% larger than the average income of the national top 1% tax units. Sources: Authors' calculations.

Distributions de revenu régionales en France, 1960–2018

RÉSUMÉ

Cet article présente la distribution des revenus de chaque département de France métropolitaine pour les périodes 1960-69 et 1986-2018. Nous nous appuyons sur des archives inédites et nouvellement numérisées du ministère français des Finances. À partir de ces sources brutes, nous interpolons l'ensemble de la distribution des revenus des départements après 1986. Avant 1986, nous avons besoin de plus d'hypothèses car seuls les ménages soumis à l'impôt sur le revenu remplissaient des déclarations d'impôt sur le revenu à cette époque. Nous proposons une méthodologie pour estimer le nombre et le revenu moyen des ménages non imposables avant 1986 qui nous permet également de reconstruire la distribution des revenus des départements pour la période 1960-69.

Mots-clés : Inégalités intrarégionales, Distribution des revenus, Géographie économique, Histoire économique.

1   Introduction

Recent political outcomes and social movements in developed economies have raised awareness of the question of spatial inequalities. Spatial inequality now interests the public, the mass media and economists alike. However, in most countries, the extent of regional disparities remains unknown. For example, in France, there are numerous debates on the existence of a territorial divide between the Paris region and the rest of France: Labrador (2013) observes strong differences in income both within the Paris region and between the Paris region and the rest of France.[1] On the contrary, Combes et al. (2011) show that, over the long run, labour productivity converged across *départements*. They put into perspective the old view that Paris dominates over the rest of France – the so called theory of *Paris and the French desert*.

In this paper, we uncover the magnitude of regional income disparities in France since 1960. More specifically, we construct homogeneous income distribution series for French metropolitan [2] *départements* (hereafter referred to simply as departments) for the period 1960-69 and 1986 onwards. Our first contribution is that we have uncovered and digitised more than 4,500 unexplored fiscal archives from the French Ministry of Finance. Our second contribution is to propose a methodology to reconstruct the income distribution of each French department. After 1986, our methodology draws on the French national income distribution estimates proposed by Garbinti et al. (2018), and on the algorithm proposed by Blanchet et al. (2021) to interpolate income distribution from fiscal tabulations. Before 1986, we need more assumptions as, at that time, only *taxable tax units* – i.e. tax units liable to pay income tax – filed a tax return. We need to estimate the income distributions of the non-taxable tax units. First, we assume that these tax units were the poorest tax units and second that their income share in each department has remained steady since 1986. Based on these two assumptions we estimate their number and average income, and from there the entire income distribution of each department.

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[1] The median monthly fiscal income in Seine-Saint-Denis, the poorest sub-region of the Paris region, was €1,257 per consumption unit in 2010, compared with €2,087 in Paris

[2] Metropolitan France is the part of France located in Europe. It comprises mainland France and Corsica, as well as other islands in the Atlantic Ocean, the English Channel and the Mediterranean Sea. It notably excludes Overseas France.

Our work is related to two fields of literature. First, it relates to the literature on spatial inequality. Up until recently, the literature on economic history and spatial inequality has used indirect and scarce measures of long-term local standards of living. In particular, Geary and Stark (2002) developed a simple methodology to reconstruct regional value added that relies only on the joint knowledge of national value added by sector, and of regional employment and wages[3]. A vast literature emerged after that (Felice & Vecchi (2015), Badıa-Miro et al. (2012), Buyst (2010), Enflo & Rosés (2015), or Schulze (2007)[4]. For lack of reliable data in France on local wages, Combes et al. (2011) produced departmental value added series using another methodology and for three dates only (1860, 1930, 2000). However, Bonnet et al. (2021) have reconstructed average income of French departments since 1922 and show that income spatial inequality may strongly differ from value added spatial inequality because of the monetary transfers (such as transfers due to the retirement or the unemployment system) that take place between regions,

Furthermore, until recently, most of the literature on spatial inequality has used data on average income per geographical unit. Few recent works such as Sommelier & Price (2018) and Gaubert et al (2021) provide a deeper understanding of spatial inequality in the US by using local income distribution series. In particular, Gaubert et al (2021) find that both states and counties have been diverging in terms of per capita pretax incomes since the late 1990s, a pattern that conceal a substantial heterogeneity across the income distribution, with a "democratization of poverty" and a "concentration of affluence". We find similar results, except that, in France, the democratization of poverty lead to a very significant reduction in interdepartmental average income inequality over the last century, and conceal the concentration of top income earners in some departments.

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[3] Their method relies on the joint knowledge of value added by sector at the national level, and of employment and wages for each region. Assuming that wages are good proxies for local productivity, the authors allocate national value added between regions. Due to the parsimony of data needed to make these estimates, this method has been used to estimate the regional value added of a large number of European countries over a long period.

[4] Each of these works sheds lights on inter-regional inequalities. For example, Buyst (2010) showed how relative regional positions changed during the 20th century in Belgium: Flanders became the richest region while Wallonia, once rich in natural resources, became the poorest. Felice and Vecchi (2015) showed how Italy's north and centre gradually converged, leaving the Mezzogiorno more and more isolated.

Second, we follow a tradition of research that estimates inequality at the country level. Piketty (2001) was the first to study top income inequality in France in the 20th century. His pioneering work gave birth to a vast literature on income inequality (Atkinson (2005), Roine and Waldenström (2008), Atkinson and Salverda (2005), Alvaredo and Saez (2009) or Alvaredo (2009). In particular, Garbinti et al. (2018) extended Piketty (2001)[5] to the entire French income distribution. We further extend their work by providing French regional income distributions.

The rest of the paper proceeds as follows. We first present our data and concepts in Section 2. We detail our methodology in Section 3. We present our newly created database and its limitations in Section 4. Section 5 concludes.

2   Data, concepts and geographical scope

2.1   Raw data

Our main data source is the newly digitised statistical papers that we have uncovered in the archives of the French Ministry of Finance. When collecting income taxes, the French tax administration previously compiled summary national statistics for each year, based on the tabulation of all individual income tax returns since 1915 (See Piketty (2001)). The Ministry of Economy and Finance called these statistical tabulations *Etats 1921*. We refer to them hereafter as fiscal tabulations. Fiscal tabulations consist of arrays of income brackets. Each income bracket provides both the number of tax units and the amount of taxable income reported by these tax units. The number and the income threshold defining the brackets have changed over the years.

The French administration produced these national statistics by summing up departmental tabulations. Official publications disclosed only national tabulations that Piketty (2001) used a century later. We discovered the raw departmental sources, in the form of administrative sheets, in the archives of the

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[5]. Piketty (2001) only estimates the income shares of the first decile. Garbinti et al. (2018) relies on Blanchet et al. (2017) to compute the entire income distribution. Garbinti et al. (2018) further extends data from 1998 to 2014 and computes distributions of income per adult (and not only per tax unit), and computes distributions of income before and after redistribution.

Ministry of Finance for the periods 1960-69 and 1986-1998. They were unused before we consulted them. The oldest fiscal tabulations were handwritten, as shown in Figure 1. The most recent ones are typewritten, as one can see in Figure 2. We found fiscal tabulations for 2001 and 2002 from ADISP, and directly online for the period 2003-18.

Fiscal tabulations summarise the taxable income that tax units report in their income statement. Taxable income is subject to many tax allowances that have varied over time (see Piketty (2001)). The tax allowances used to calculate taxable income and the final tax payable by the tax unit change with the legislation. The tax unit includes the tax filer, his or her spouse if married or in a civil union, and the dependants living with him or her.

There are two types of fiscal tabulations in the archives, one for taxable tax units, and one for non-taxable tax units. Taxable tax units are tax units whose income tax is non-null.

Between 1960 and 1969, tax tabulations are available only for taxable tax units. From 1986 onwards, tax tabulations are available for both taxable and non-taxable tax units. In total, we have digitised more than 4,500 fiscal tabulations.

Figure 1: A handwritten fiscal tabulation in 1962

Figure 2: A typewritten fiscal tabulation in 1988

For the period 1960-65, tax tabulations exist for 90 French metropolitan departments. From 1966 onwards, they cover 95 departments. The difference between these two periods stems from the Paris region which was split into three departments before 1966 (Seine, Seine-et-Oise, Seine-et-Marne) and eight thereafter (Paris, Hauts-de-Seine, Seine-Saint-Denis, Val-de-Marne, Essonne, Yvelines, Val-d'Oise, Seine-et-Marne).

To compute these distributions at local level, we use the populations by age, department and year estimated by Bonnet (2020). In this paper, the author calculates these age-specific populations between 1901 and 2014 from age-specific populations counted at regular intervals, and births and age-specific deaths available from the civil registry for each year. We extend this database to the period 2015-18.

2.2 Income concepts

There are several ways to represent income inequality depending on the concept of income and the population units used. Following Garbinti et al. (2018) we provide two types of income series: (i) fiscal income without capital gains, and (ii) fiscal income with capital gains. Fiscal income is a concept of income that is distinct from that of taxable income. Fiscal income is the income declared by the tax unit, before considering the tax allowances used to calculate the final amount of tax.

We compute distributions of fiscal income per tax unit.[6]

2.3   Geographical scope

Interestingly, France, unlike many of its European neighbors, is a unified country whose metropolitan borders have not changed much for the last 150 years. There has been no change since 1960, the start of our study[7]. The borders of departments have also changed very little except the split of the Paris region in 1966 that we have detailed in Section 2.1 and the split of the Corsica region in two departments in 1975 (Haute-Corse and Corse-du-Sud). We keep Corsica as a sole department in our study. We produce distributions of fiscal income for the departments of Paris, Hauts-de-Seine, Seine-Saint-Denis, Val-de-Marne, Essonne, Yvelines and Val-d'Oise since 1966 onwards. However, we compute distributions of fiscal income for the departments of Seine and Seine-et-Oise for the entire period[8]. Hence, we produce distributions of fiscal income for 95 metropolitan departments from 1960 to 1965 and 97 department since 1966. We then aggregate our income series to produce distributions of fiscal income for upper geographic levels.

Eventually, we produce distributions of fiscal income for mainland France (later referred to as "national" level) and for three geographical levels, corresponding to the three levels of the Nomenclature of Units for Territorial Statistics (NUTS): departments (97 units, NUTS 3), administrative regions that existed between 1970 and 2015 (22 regions, NUTS 2), and administrative regions that have existed since 2016 (13 regions, NUTS 1). We detail these geographical levels in Appendix 2.

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[6]We would also like to compute distributions of fiscal income per adult. We plan to collect tax tabulations by type of tax unit (tax unit with 1 adult, tax unit with 2 adults, tax unit with 1 adult and 1 dependant aged over 18, tax unit with 2 adults and 1 dependant aged over 18) for each year and each department. To date, we have collected these tax tabulations for only 4 years: 1987, 1990, 1993, 1996.

[7] The last major change dates back to the incorporation of the comtés of Savoie and Nice in 1860. Since then, the only changes have been the temporary exclusion of the departments of Alsace-Moselle from the French administration between 1870 and 1918, and during the Second World War.

[8] To obtain the tax tabulations of Seine from 1966 onwards, we add together the tax tabulations of the departments of Paris, Hauts-de-Seine, Seine-Saint-Denis and Val-de-Marne. To obtain the tax tabulations of Seine-et-Oise, we add together the tax tabulations of the departments of Yvelines, Essonne and Val-d'Oise.

3 Methodology

In this section, we describe the methodology that we propose to reconstruct the income distributions at a regional level in France. For the entire period studied, we need to construct fiscal income series that are more homogeneous than taxable income series. We also need to make more assumptions before 1986 because there are no fiscal tabulations available for non-taxable tax units before that date. Hence, there are two different periods in terms of methodology: after 1986 and before 1986.

3.1 Methodology from 1986 onwards

From 1986 onwards, we construct fiscal income series using taxable income series. Broadly speaking, we interpolate income distributions from our income tabulations using the methodology of Blanchet et al. (2021). We transform our taxable income distribution into fiscal income distributions using the enhancement rate taken from Garbinti et al. (2018).[9]

Cleaning fiscal tabulations Blanchet et al. (2021) provide an algorithm that reconstructs very accurately the income distribution from fiscal tabulations. The algorithm requires the lower threshold of the highest bracket to be high enough to estimate accurately the top of the income distribution. Similarly, the upper threshold of the lowest bracket must be low enough to estimate accurately the bottom of the income distribution. In addition, the total number of brackets should not be too small to fit the middle of the distribution. Except in 2001 and 2002, the number of brackets and the position of the thresholds in the income distribution meet these conditions.

In 2001 and 2002, there were only six brackets in the fiscal tabulations at the department level. We correct this by creating additional brackets. We transform fiscal tabulations at the department level for years 2001 and 2002 into tabulations with 12 brackets by applying the following rule:[10] we define p_j^d as

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[9] These enhancement rates map the taxable income percentiles to fiscal income percentiles. We make sure our estimates are consistent with those of Garbinti et al. (2018) at the national level.

[10] From 2003 to 2005, the fiscal administration kept the bracket thresholds of the previous years but doubled the number of brackets by splitting them into smaller brackets. For example, the 0–9,000 bracket in 2001-02 was divided into two brackets in 2003: 0–7,500 and 7,500–9,000. At the national level, the fiscal tabulations for 2001 and 2002 already comprised 12 brackets.

the share of tax units belonging to bracket j among all tax units in department d. We similarly define p_j as the share of tax units belonging to bracket j among all French tax units. We impose that

$$\left(\frac{p_j^d}{p_j}\right)_t = \left(\frac{p_j^d}{p_j}\right)_{2003} \quad \forall t \in \{2001, \ 2002\}$$

In a few isolated cases, the number of tax units for a specific bracket is too small in a given department for a given year to interpolate the income distribution – always in rural and sparsely populated departments, and for brackets at the top of the income distribution. In those cases, we add together consecutive brackets.

Taxable income distributions We recover the taxable income distributions of each French metropolitan department by applying the algorithm developed by Blanchet et al. (2021). This non-parametric method interpolates very precisely the whole income distribution. We use the *gpinter* package for .R software provided by the authors.

Fiscal income distributions Taxable income refers to the income earned by tax unit minus specific deductions imposed by income tax law. We need to correct for these deductions because they have varied greatly over the years. We do this by transforming our taxable income distribution into (i) a fiscal income without capital gains distribution, and (ii) a fiscal income with capital gains distribution. We apply the following rule:

$$Y_{x,t}^{H,d} = Y_{x,t}^{T,d} \frac{Y_{x,t}^{H,F}}{Y_{x,t}^{T,F}}$$

where $Y_{x,t}^{H,d}$ is the average income in quantile x of the H income distribution of department d in year t, and H stands either for (i) fiscal without or (ii) fiscal with capital gains. $Y_{x,t}^{T,d}$ is the average income in quantile x of the taxable income distribution of department d in year t. $Y_{x,t}^{H,F}$ is the average income in quantile x of the H income national distribution in year t, $Y_{x,t}^{T,F}$ the average income in quantile x of the taxable income national distribution in year t. We derive $Y_{x,t}^{H,F}$ and $Y_{x,}^{T,F}$ from Garbinti et al. (2018). The underlying assumption is that the rank of a tax unit in the national taxable income distribution is equal to its rank in the income distribution.

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Consistency with national estimates We make sure our results are consistent at the national level with the estimates produced by Garbinti et al. (2018). When we add up our department estimates, we find a slight difference of around 1% with national estimates. We correct our own national average income estimate to make it match with Garbinti et al. (2018). However Garbinti et al. (2018) include overseas departments when computing national estimates, whereas we work only with metropolitan departments.[11] We define $Y^{T,n}$ as the average national taxable income. We similarly define $Y^{T,m}$ as the average taxable income of metropolitan departments. We can get $Y^{T,n}$ and $Y^{T,m}$ from fiscal tabulations. We define $Y^{F,n}$ as the average national fiscal (with or without capital gains) income estimate of Garbinti et al. (2018). We define $Y^{F,m}$ as our estimate of the average fiscal income of metropolitan departments before adjustment. We homogeneously correct the income distribution of each department. We multiply the income of each tax unit by:

$$\frac{Y_t^{F,n}}{Y_t^{F,m}} \times \frac{Y_t^{T,m}}{Y_t^{T,n}} \quad \forall t = \{1986, ..., 1998, 2001, ..., 2014\}$$

We make sure that the latter is consistent with national estimates only in terms of average. We need to make sure that the income share of each quantile of the national distribution is close to the same quantile of the summed distribution. We test the fit of our estimates by comparing the P0P50, P50P90, P90P99 and P99P100 shares in the Garbinti et al. (2018) estimates with our adjusted estimates. Figure 5 presents the results of this comparison. Differences are very small for this period.

Garbinti et al. (2018) estimates end in 2014. After that date, we have no estimate of the average national fiscal income, but we know from the French of Ministry of Finance website the average national taxable income. We assume that the ratio of the average national fiscal income to the average national taxable income is constant after 2014. We also assume that the enhancement rates we have described above are constant after 2014.

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[11] The geographical scope of Garbinti et al.'s (2018) national estimates is inconsistent as it only includes Mayotte after 2013.

3.2   Methodology for the 1960-69 period

For the 1960-69 period, we only have fiscal tabulations for the taxable tax units. We use a four-step procedure to reconstruct the income distributions by tax unit of each department. First, we estimate the fiscal income distributions of taxable tax units. Second, we estimate the number of non-taxable tax units by department and year. Third, we estimate the mean fiscal income of non-taxable tax units by department. Fourth, we estimate the fiscal income distributions of all tax units.

Fiscal income distributions of taxable tax units We recover the taxable income distributions of taxable tax units by applying the algorithm developed by Blanchet et al. (2021). Then, we transform our taxable income distribution into (i) fiscal income without capital gains distribution, and (ii) fiscal income with capital gains distribution, using equation (xx).

Estimation of non-taxable tax units We recover the total number of tax units by department based on an econometric method. We run the following regression for years 1986–2010:

$$N_t^d = \alpha_0 + \sum_{a=1}^{6} \alpha_a P_t^{d,a} + \beta M_t^d + \gamma N_n + \delta_d + \varepsilon_t^d$$

N^d is the total number of tax units of department d, N^n the total number of tax units at the national level, M^d the number of married couples in department d, $P^{d,a}$ the number of individuals in the age group a in department d – there are six age groups a –. δ^d is a department fixed effect, and ε^d is an error term. We do not use the years 2011 onwards to fit the model because the definition of a tax unit changed after 2011. Since 2011, married and divorced couples no longer have to fill in three tax returns in the year of their union or divorce. Overall, the R^2 is equal to 0.9996. We use the coefficients of this model and data for the period 1960-69 to estimate the total number of tax units in each department between 1960 and 1969, and deduct the number of non-taxable tax units.[12]

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[12] To get married couples for each year, we use linear approximations between each census date. To get populations by age and married couples in Seine in 1969, we add together the values of Paris, Hauts-de-Seine, Seine-Saint-Denis and Val-de-Marne. To get populations and married couples in Seine-et-Oise in 1969, we add the values of Yvelines, Essonne and Val-d'Oise. To get populations and married couples of Yvelines, Esonne, Hauts-de-Seine, Seine-Saint-Denis, Val-de-Marne, Val-d'Oise in 1966 and 1967, we distribute the values of Seine and Seine-et-Oise pro rata the values in 1968.

We test the consistency of our estimates. We sum up the estimated departmental tax units. We then compare them to the national tax units of Garbinti et al. (2018). Our estimates slightly differ from national estimates because of overseas departments. If we assume that the share of overseas departments in the total number of tax units is 1%, then we overestimate the total number of metropolitan tax units by 1.8% points in 1966 and 1.25% point in 1969. We adjust homogeneously our tax number estimates to correct for this discrepancy.

We compare our method to another methodology. In this method, we assume that all individuals aged over 20 complete a tax return unless they are married. Then we computes total fiscal units by subtracting the total number of married couples from the total of individuals aged 20 or over.

We compare the fit of the two methods by comparing predicted values and observed values for the years 1986 to 2010. Table 1 presents the distribution of these differences (in percentage). On average, our preferred method estimates the number of tax units very accurately between 1995 and 2010. Before 1994, we overestimate slightly more values, in particular in 1986 when non-taxable tax units were required to fill in a tax return for the first time. The second method performs less well (annual median and maximum errors are always larger in the second method).

Table 1: Annual distributions of departmental differences between tax units observed and predicted according to the two methods (in %)

Year	Preferred Method					Second Method				
	Min (1)	Quart. 1	Méd.	Quart. 3	Max	Min	Quart. 1	Méd.	Quart. 3	Max
1986	-3.6	-0.8	0.5	3.1	20.1	-0.2	2.65	4.7	9.95	46
1990	-2.9	-1.35	-0.7	0.3	6.1	-1.5	0.75	2	4.5	24.2
1994	-2.4	-0.3	0.1	0.6	2.9	-1.3	1.1	1.8	3.4	17.2
1998	-3.8	-0.8	-0.2	0.2	1.7	-4.4	-1.1	-0.3	0.9	6.3
2002	-4.1	-0.55	0.3	0.65	1.6	-7.3	-1.7	-0.6	0.25	4.2
2006	-3.8	-0.4	0	0.65	3.1	-7.4	-2.35	-1.4	-0.7	3.2
2010	-3	-0.2	0.7	1.45	5	-7	-2.45	-1.2	-0.2	4.1

Note: Our preferred method estimates tax units using an econometric method based on demographic data. The second method estimates tax units by subtracting married couples from the adult population. "Quart. 1" means that 25% of observations have

a difference lower than the threshold. "Med." is the usual median. Sample includes 95 departments. Values in percentage are the ratio between tax units estimated and those recorded.

Figure 3 presents the share of non-taxable tax units in all tax units for the years 1962, 1964, 1966 and 1968. The figure also presents the mean of this share across departments. Non-taxable tax unit shares were high in the early 1960s (7 out of 10 tax units were non-taxable). These shares declined to approximately 50% in the late 1960s. There were strong disparities between departments. For instance, in 1962, the share of non-taxable tax units exceeded 80% in some departments (Aveyron, Cantal, Creuse, Dordogne, Vendée), while it was less than 50% in the Rhône, Seine, and Seine-et-Oise. These disparities were still strong in 1968.

Average income of the non-taxable tax units   We also need to estimate the mean income of the non-taxable tax units. This value is different from one department to another. To distribute the income of non-taxable tax units between departments, we make two assumptions.

First, we make the plausible assumption that the non-taxable tax units are the tax units at the bottom of the income distribution of their department. According to Piketty (2001), taxable tax units are typically richer than non-taxable tax units, but this is not always the case. Some rich and large families may be non-taxable because the French income tax scale depends on the size of the family. These situations are very rare however.

We further assume that the income share of the non-taxable tax units during the 1960-69 period is equal to the income share of the x_d poorest tax units in 1986, where x_d is equal to the share of non-taxable tax units in 1960-69. We make this assumption for each department. In mathematical terms, it means:

$$L_t^d\left(\frac{N_{0,t}^d}{N_{0,t}^d + N_{1,t}^d}\right) = L_{1986}^d\left(\frac{N_{0,t}^d}{N_{0,t}^d + N_{1,t}^d}\right)$$

for any $t \in \{1960-1969\}$ and d, where we define N_1^d as the number of taxable tax units in department d, N_0^d as the number of non-taxable tax units, $L_t^d(x)$ as the income share of the x_d poorest tax units in year t and department d. L_t^d is the Lorenz curve of the income distribution of department d in year t.

We deduce the average income of tax units living in department d with the following formula:

$$Y^d = \frac{Y_1^d}{1 - \tilde{L}\left(\frac{N_0^d}{N_0^d + N_1^d}\right)} \frac{N_1^d}{N_1^d + N_0^d}$$

We define Y^d as the average income of all tax units in department d, Y_1^d as the average income of the taxable tax units, and Y_0^d as the average income of the non-taxable tax units.

Figure 3: Share of non-taxable tax units
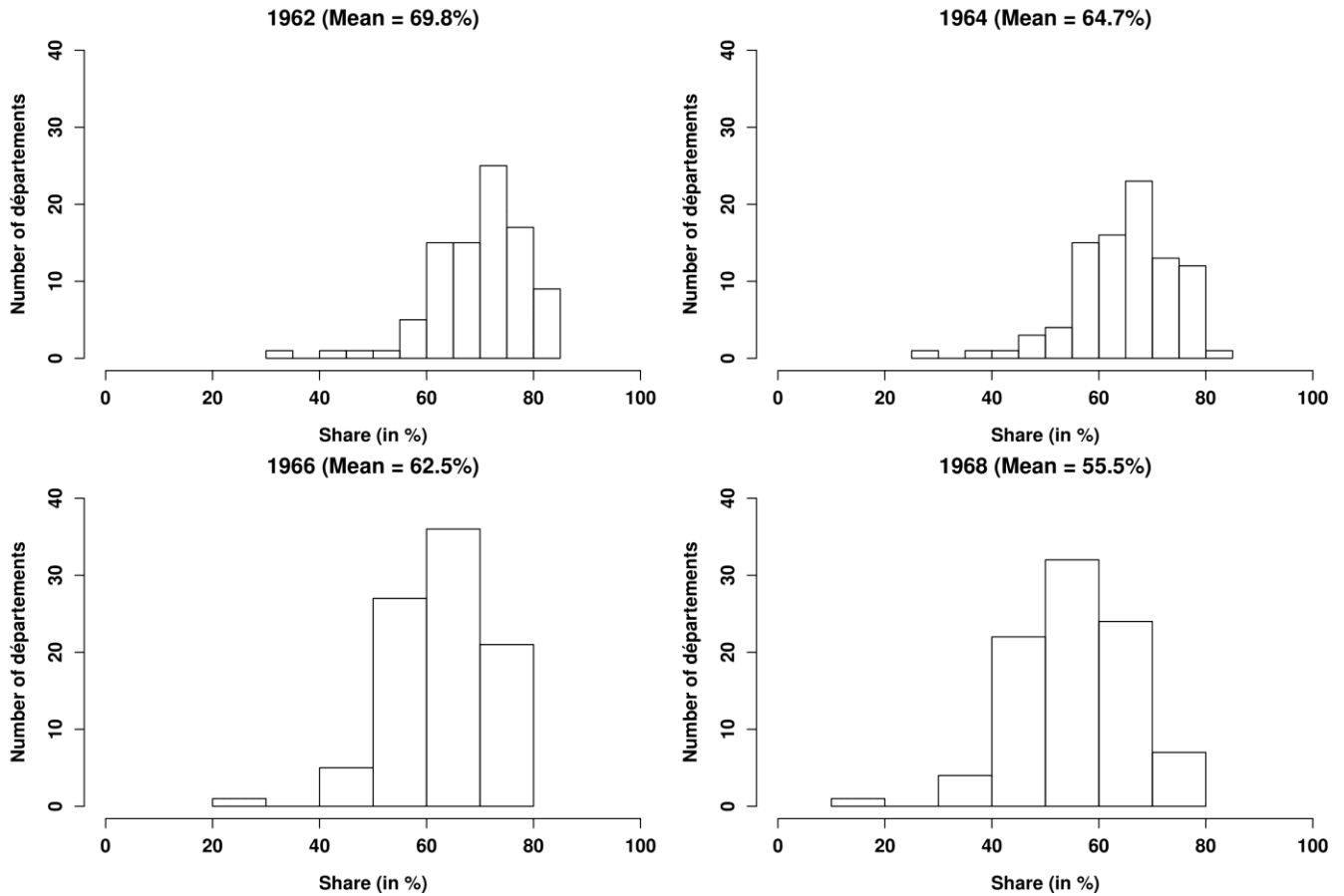
Note: We compute non-taxable unit shares by dividing the number of non-taxable units by the total of tax units in each department. We then plot the histogram of these shares for the years 1962, 1964, 1966, 1968. We also print the mean of these shares at each of these dates.

Eventually, we check that the sum of departmental fiscal incomes is equal to the total fiscal income at the national level. The difference is between -2% and +2% depending on the year. Figure 4 shows the

departmental distribution of the share of fiscal income declared by taxable tax units between 1960 and 1969 between 1960 and 1969. The red line represents the share of fiscal income of taxable tax units at the national level. The solid black line represents the departmental median of these shares. The dashed represents the interquartile range of these departmental shares and the dotted lines the minimum and the maximum. Figure 4 indicates how critical are our assumptions to redistribute the fiscal income of non-taxable tax units among departments. In particular, the evolution of the red line says that the share of fiscal income declared by taxable units increased at the national level between 1960 and 1969 from 62% to 70%. It means that in 1969 we only must reallocate 30% of the total national fiscal income among non-taxable tax units. In 1969, for half of the departments, the share of fiscal income declared by taxable tax units was upper than 67% of the department's total fiscal income. In the departments of Seine and Seine-et-Oise, the share was around 90%.

Figure 4: Share of taxable income declared by taxable tax units
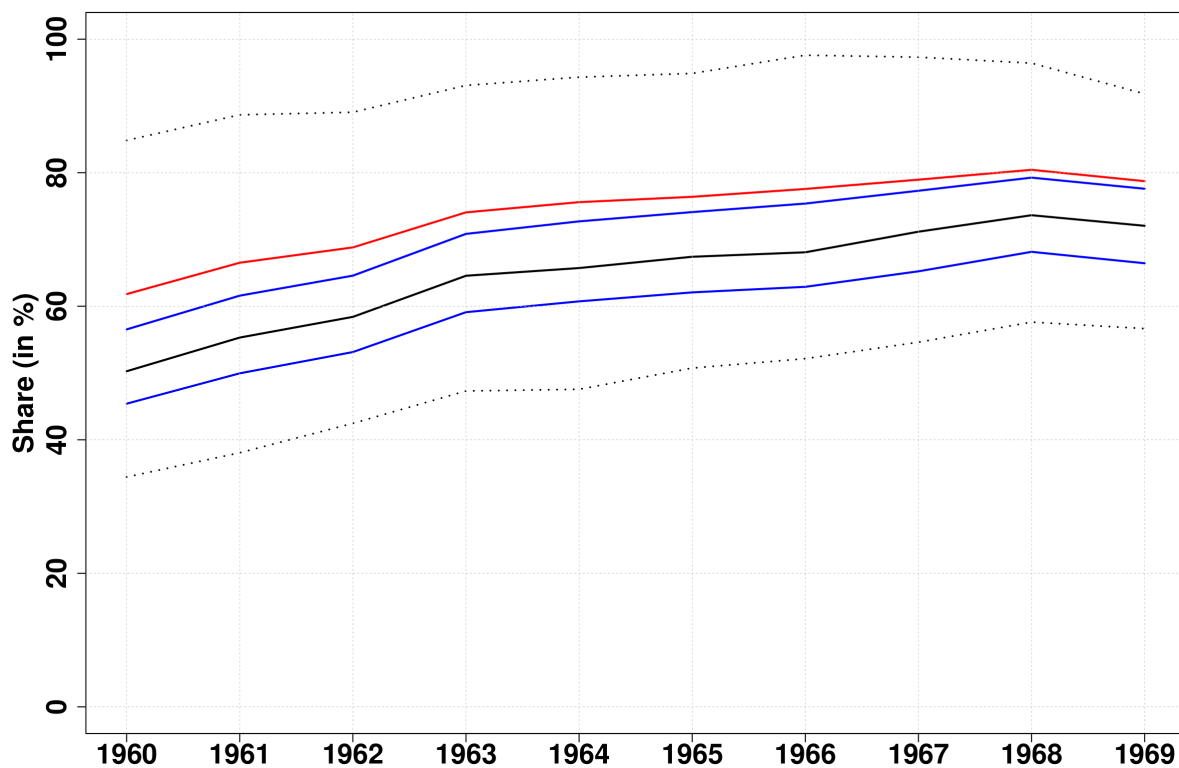
Note: Red curve for national share. Black solid line for median of departmental values. Blue solid lines for interquartile interval. Black dotted lines for minimum and maximum of departmental values.

Fiscal income distributions of tax units We recover the fiscal income distributions including both taxable and non-taxable tax units by applying the algorithm developed by Blanchet et al. (2021).

3.3   Consistency tests

Figure 5 compares the income shares of the national distribution and the sum of departmental distributions for different part of the income distribution. We estimate very accurately the whole income distribution (Bottom 50%, Middle 50-90%, Top 10 and Top 0.1%) for the period 1986-2018. We estimate precisely top income shares (Top 10 and Top 0.1%) in 1960-1969. However, we do less good within the bottom 90% in 1960-1969.

3.4   Distributions of fiscal income: final format

We provide our distributions of fiscal income in a final format that follows the guidelines by Alvaredo et al. (2016).

Each distribution provides a set of information. For each quantile, it gives (1) the income threshold that must be exceeded to be part of the quantile (*Brac Low Thres*), (2) the average income of the fractile (*Brac Avg Inc*), (3) the share of total income owned by the fractile (*Brac Sh Inc*), (4) the total income share held by all tax units above the threshold (*Top Sh Inc*), (5) the number of tax units in each fractile (*Brac Pop*), and the income threshold that must be exceeded to enter the fractile, expressed as a percentage of the average departmental income (*BLT Avg r*).An additional row has been added (Quantile = 1) to get information on the whole distribution. One can find the average fiscal income per tax unit (column *Brac Avg Inc*), the Gini index (column *Brac Sh Inc*), and the total number of tax units in the department (column *Brac Pop*).

Figure 5: Income shares of the national distribution and the sum of department distributions
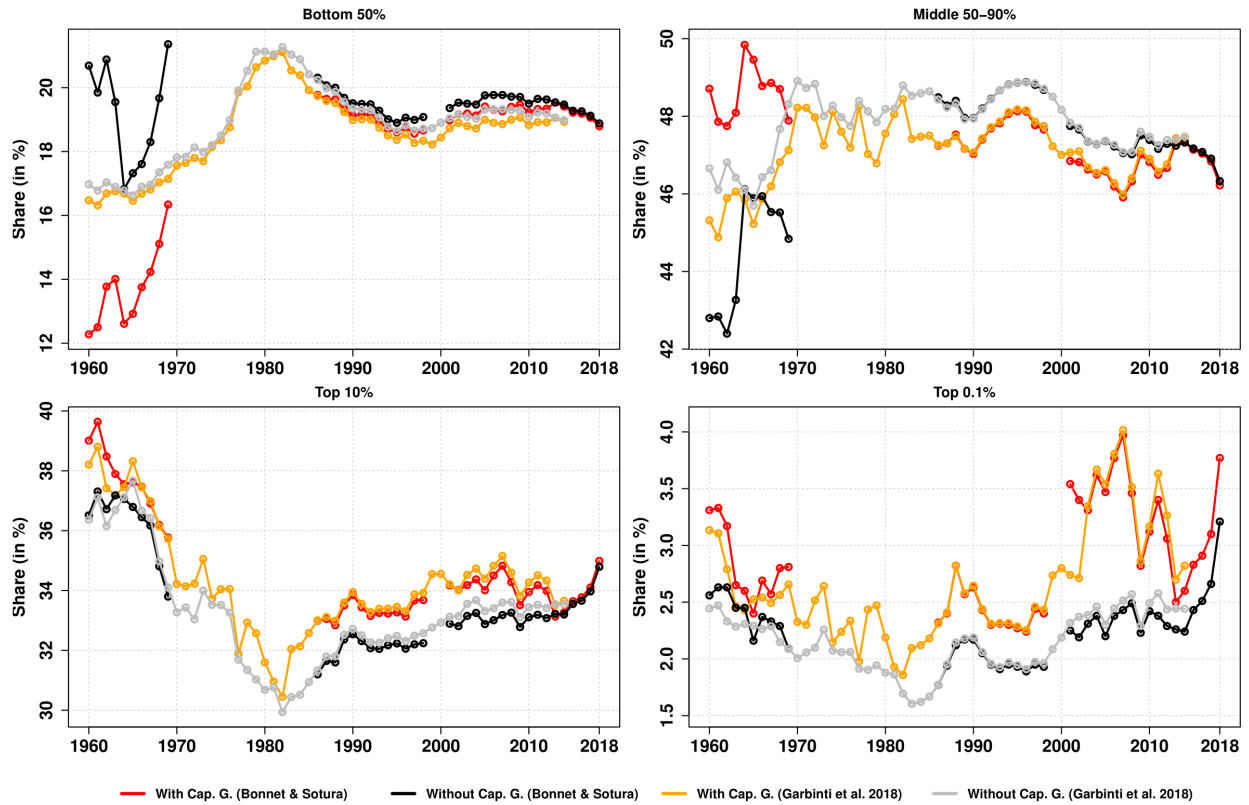
Note: These figures compare the income shares of two income distributions: (i) the national distribution (Garbinti et al. 2018) and (ii) the sum of departmental income distributions (Bonnet & Sotura), for both fiscal income with capital gains (With Cap. G.) and fiscal income without capital gains (Without Cap. Gains). The first figure presents the income shares of the five last deciles of tax units (Bottom 50%). The second presents the income share of the next 4 intermediary deciles of tax units (Middle 50-90%). The third figure presents the income share of the first decile of tax units (Top 10%). The fourth figure presents the income share of the first millime of tax units (Top 0.1%).

Table 2 provides an example: the department distribution of fiscal income (with capital gains) for the department of "Ain" in 2015.

Using our distributions of fiscal income at department level (NUTS 3), we compute distributions of fiscal income for the administrative regions that existed between 1970 and 2015 (NUTS 2 level), the current administrative regions (NUTS 1 level), and for metropolitan France as a whole. For each region, we compute distributions of fiscal income for each of its department. We then aggregate these departmental

distributions and compute the regional distribution of fiscal income. We use the same process to compute the distribution of fiscal income for metropolitan France.

Table 2: Distribution of fiscal income (with capital gains) in Ain in 2015

TYear	TDept	Quantile	Brac_Low_Thres	Brac_Avg_Inc	Brac_Sh_Inc	Top_Sh_Inc	Brac_Pop	BLT_Avg_d
2015	1	0	-	2 481	0,0072	1	33 718	0,000
2015	1	0,1	5 613	9 543	0,0278	0,9928	33 718	0,164
2015	1	0,2	12 762	14 904	0,0435	0,9649	33 718	0,372
2015	1	0,3	16 950	18 604	0,0542	0,9215	33 717	0,494
2015	1	0,4	20 321	22 240	0,0648	0,8672	33 717	0,592
2015	1	0,5	24 405	27 368	0,0798	0,8024	33 717	0,712
2015	1	0,6	30 667	34 447	0,1004	0,7226	33 717	0,894
2015	1	0,7	38 523	43 539	0,1269	0,6222	33 717	1,123
2015	1	0,8	49 221	57 230	0,1669	0,4952	33 717	1,435
2015	1	0,9	67 278	68 679	0,0200	0,3284	3 372	1,962
2015	1	0,91	70 150	71 788	0,0209	0,3084	3 372	2,045
2015	1	0,92	73 514	75 461	0,0220	0,2874	3 372	2,143
2015	1	0,93	77 544	79 877	0,0233	0,2654	3 372	2,261
2015	1	0,94	82 333	85 220	0,0248	0,2421	3 372	2,400
2015	1	0,95	88 396	92 259	0,0269	0,2173	3 372	2,577
2015	1	0,96	96 570	102 126	0,0298	0,1904	3 372	2,816
2015	1	0,97	108 490	117 354	0,0342	0,1606	3 372	3,163
2015	1	0,98	128 109	145 741	0,0425	0,1264	3 372	3,735
2015	1	0,99	170 461	194 189	0,0283	0,0839	1 686	4,970
2015	1	0,995	226 942	294 443	0,0343	0,0556	1 349	6,617
2015	1	0,999	436 889	728 900	0,0213	0,0213	337	12,738
2015	1	1	NA	34298	0,4551	NA	337175	NA

Note: This table provides an example of the distributions of fiscal income estimated. For each quantile, it gives the income threshold that must be exceeded to be part of the quantile (Brac Low Thres), the average income of the fractile (Brac Avg Inc), the share of total income owned by the fractile (Brac Sh Inc), the total income share held by all tax units above the threshold (Top Sh Inc), the number of tax units in each fractile (Brac Pop), and the income threshold that must be exceeded to enter the fractile, expressed as a percentage of the average departmental income (BLT Avg r). An additional row has been added (Quantile = 1) to get information on the whole distribution. One can find the average fiscal income per tax unit (column Brac Avg Inc), the Gini index (column Brac Sh Inc), and the total number of tax units in the department (column Brac Pop).

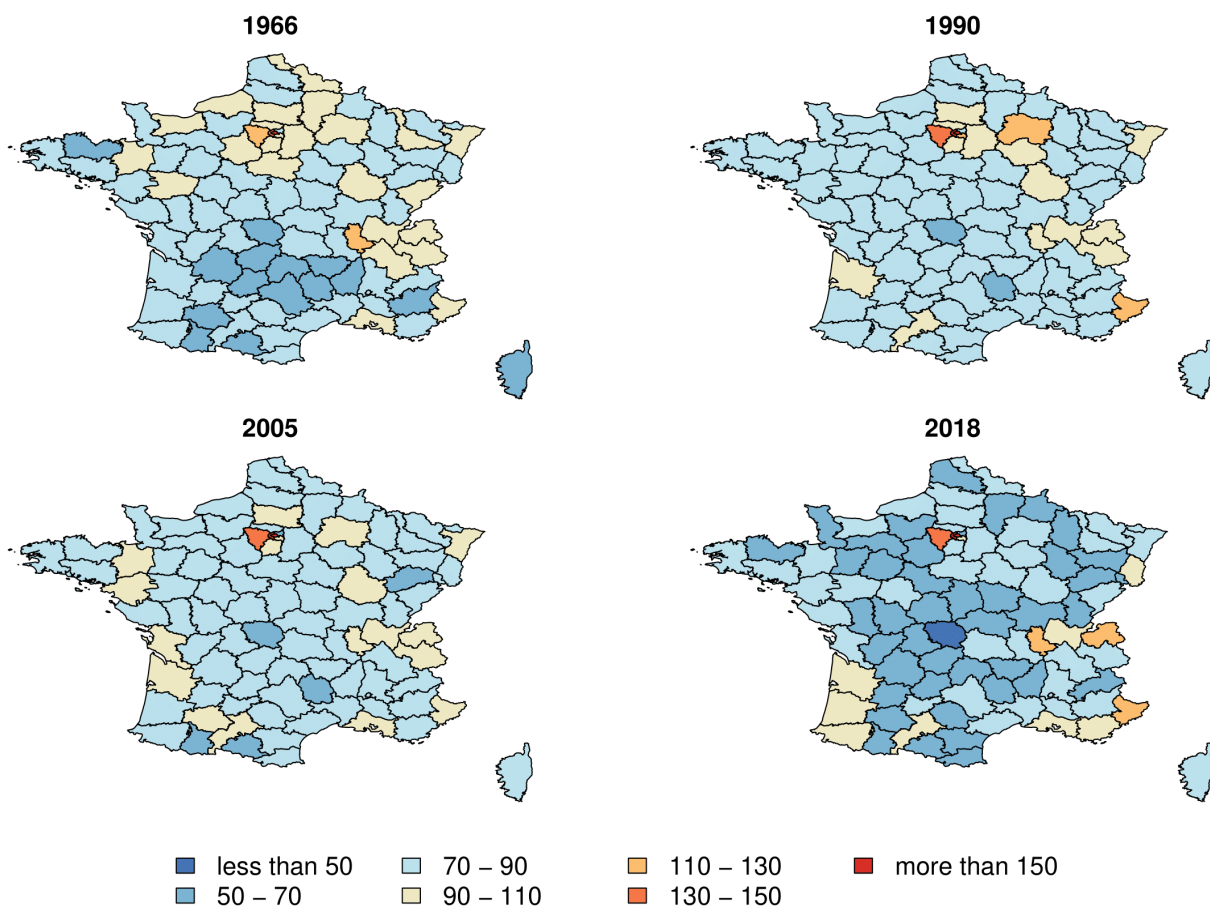# 4   Available results and discussion

4.1   Available results

Our database provides the average fiscal income per tax unit for each quantile and department. To illustrate this point, Figure 6 maps the relative fiscal income of the top 1% (defined as the 1% of tax units with the highest income) for four years: 1966, 1990, 2005 and 2018. We obtain this relative fiscal income by dividing the fiscal income of the top 1% in the department by the fiscal income of the top 1% at the national level. A dark blue color means that the fiscal income of the top 1% is lower than the national average; a dark red color means that the fiscal income is higher than the national average.

Figure 6 reveals that the fiscal income of the top 1% was well below the national average in many departments in 1966, mostly located in the south and west of the country. The rural departments of the southwest had the lowest values (between 50% and 70% of the metropolitan average). Conversely, the departments close to Paris, as well as in the Rhône, had the highest values. After a period of homogenisation where values between 50% and 70% almost entirely disappeared, the map for 2018 reveals a highly polarised France: the fiscal income of the top 1% is between 50% and 70% of the metropolitan average in many departments. In Creuse, the income of these tax units is less than half the metropolitan average. In Ile-de-France, the situation is highly polarised too if we compare Paris, Hauts-de-Seine and Yvelines with Seine-Saint-Denis.

Figure 7 shows the trends in the relative fiscal income of the top 10% (defined as the 10% of tax units with the highest income) for the departments of four regions (NUTS 1): Centre-Val de Loire, Bretagne, Normandy and Hauts-de-France. In each quadrant, the departments belonging to the region are presented (ranked by colour according to the value in 2018), as well as the region (in black dashed lines). The years 1970-85 and 1999-2000 are not available.

Figure 7 shows that the relative fiscal income of these tax units is below the metropolitan average in these four regions. Globally, values have declined since the mid-1980s. Nevertheless, we observe departmental differences: values are close to the metropolitan average in Loiret, Côte-d'Or and Oise, whereas they are very low in Indre, Nièvre, Orne and Pas-de-Calais (close to 70%).

Figure 6: Fiscal income of the top 1% (% of the national average)

1966

1990

2005

2018

■ less than 50	□ 70 – 90	□ 110 – 130	■ more than 150
□ 50 – 70	□ 90 – 110	■ 130 – 150	

Note: We define the top 1% as the 1% of tax units with the highest income. A dark blue colour means that the fiscal income of the top 1% is lower than the national average; a dark red colour means that the fiscal income is higher than the national average.

With the database we have created, one can also know where tax units belonging to each quantile (defined at the metropolitan level) are located. Figure 8 reveals the share of tax units with income below the metropolitan median level for years 1966, 1990, 2005 and 2017. A dark red colour means that this share is high, while a dark blue colour means that this share is low. If each department presented a value of 50%, then tax units with income below the median metropolitan level would be perfectly distributed across France.

Figure 7: Trends in fiscal income of the top 10%
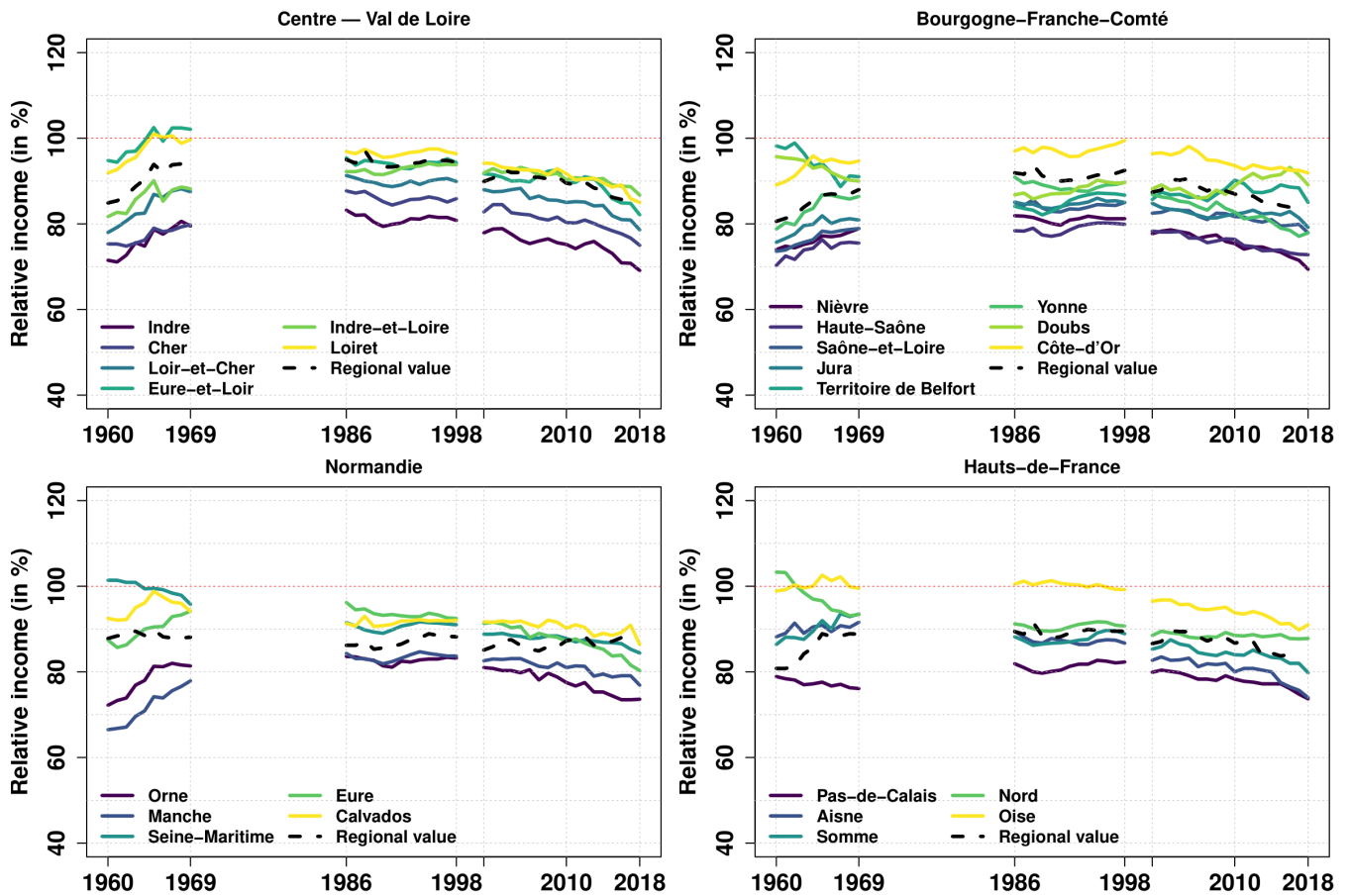
Note: We define the top 10% as the 10% of tax units with the highest income (first decile). We express values as a percentage of the national average. We rank the departments of each region according to their value in 2018. Values are missing for the periods 1970-1985 and 1999-2000.

In 1966, this share was above 62.5% in many departments in the southwest and the east of the country. Conversely, it was particularly low in the departments belonging to Ile-de-France, and in the Rhône, Ain, Alpes-Maritimes and Gironde. The situation gradually homogenised. There were no departments with values above 62.5% in 2017. The departments with the highest values are now in the north and southwest of the country, while the departments near borders (especially Haute-Savoie) and those in Ile-de-France have the lowest values.

Figure 8: Share of tax units belonging to the five last deciles

1966

1990

2005

2017

■ less than 37.5	■ 42.5 – 47.5	■ 52.5 – 57.5	■ more than 62.5
■ 37.5 – 42.5	■ 47.5 – 52.5	■ 57.5 – 62.5	
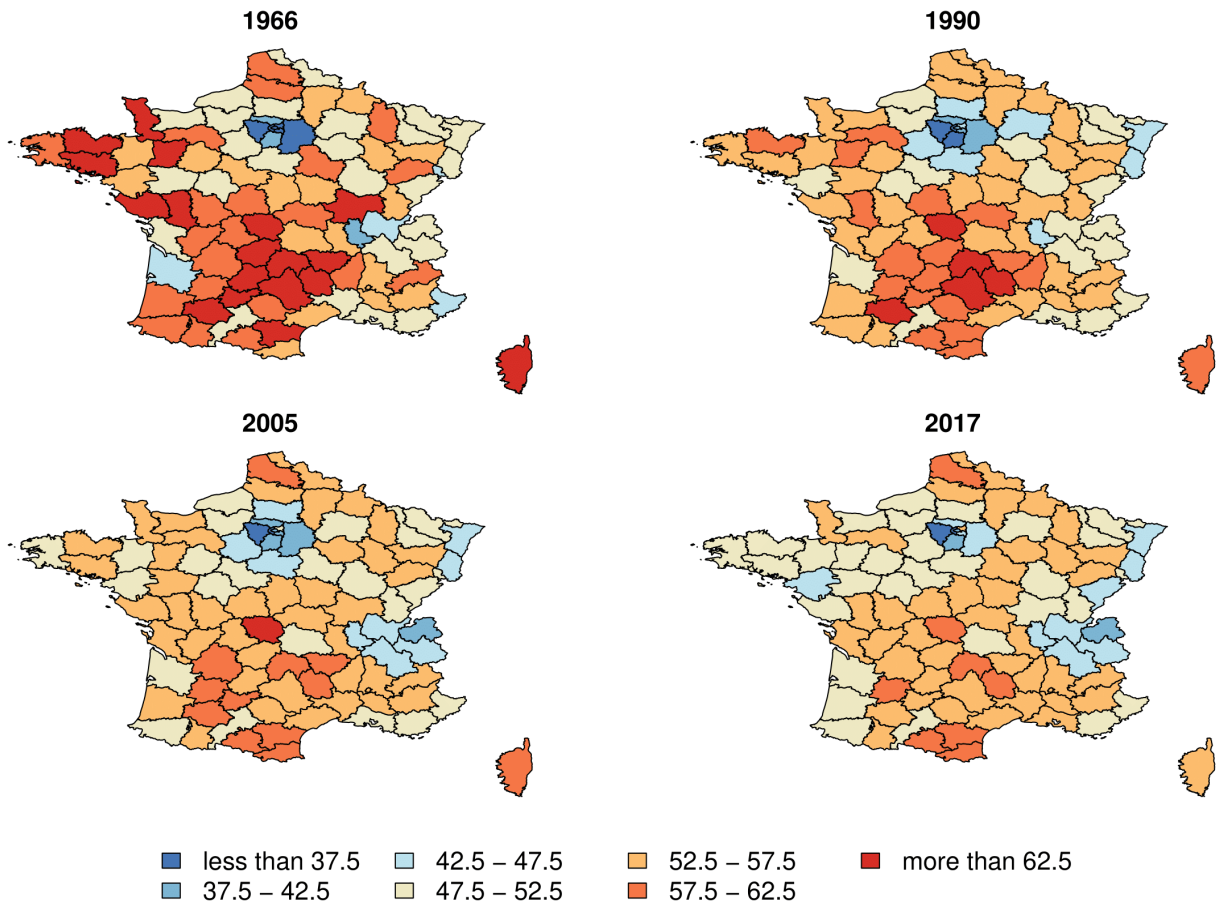
Note: We define the bottom 50 threshold at the national level (all tax units whose income is below the national median). A dark blue colour means that the share of the bottom 50 tax units is low; a dark red colour means that this share is high.

4.2 Discussion

Distributions of fiscal income per tax unit or per adult

In this article, we compute the distributions of fiscal income by tax unit. Tax units can be composed of several adults of the same generation. This is particularly true when they live as a couple. They can also be composed of several generations, for example, when the children are minors, or when elderly individuals live with one of their children.

Ideally, we would like to get distributions of fiscal income per adult. To do so, we would need to obtain tax tabulations by type of tax unit and compute several sets of distributions according to the number of adults in the tax unit. We currently only have these data for the years 1987, 1990, 1993 and 1996. We therefore plan to compute distributions of fiscal income per adult for these 4 years to verify that they are similar to the distributions of fiscal income per tax unit.

The data available to date allow us to ascertain to what extent fiscal income per tax unit overestimates fiscal income per adult in each department. Indeed, the ratio between the two concepts is equal to the ratio between the number of adults and the number of tax units. At the national level, the number of adults was 60% higher than the number of tax units in 1966. This value has declined steadily over the period covered by this study. It was 48% in 1986, 35% in 2005, and 34% in 2015. At the departmental level, large disparities have existed, as one can see in Figure 9. In 1966, the values ranged from 34% to 94%, with the maximum value in Corsica. Over time, they have gradually converged: in 2015, they ranged from 22% to 42%.

If we assume that the number of adults per tax unit is similar along the income distribution, then we could use the previous ratios to approximate the fiscal incomes per adult for each quantile. Furthermore, under this assumption, the shares of total income held by each quantile remain unchanged.

Missing years In this article, we compute distributions of fiscal income per tax unit for each department during the periods 1960-69, 1986-98 and 2000-18 using fiscal tabulations available in the archives. They are missing for the years 1915-59, 1970-85 and 1999-2000. Yet income tax existed during these periods, and fiscal tabulations exist at the national level. They allowed Garbinti et al. (2018) to compute distributions of fiscal income for France over 100 years.

Figure 9: Difference between number of adults and number of tax units by department
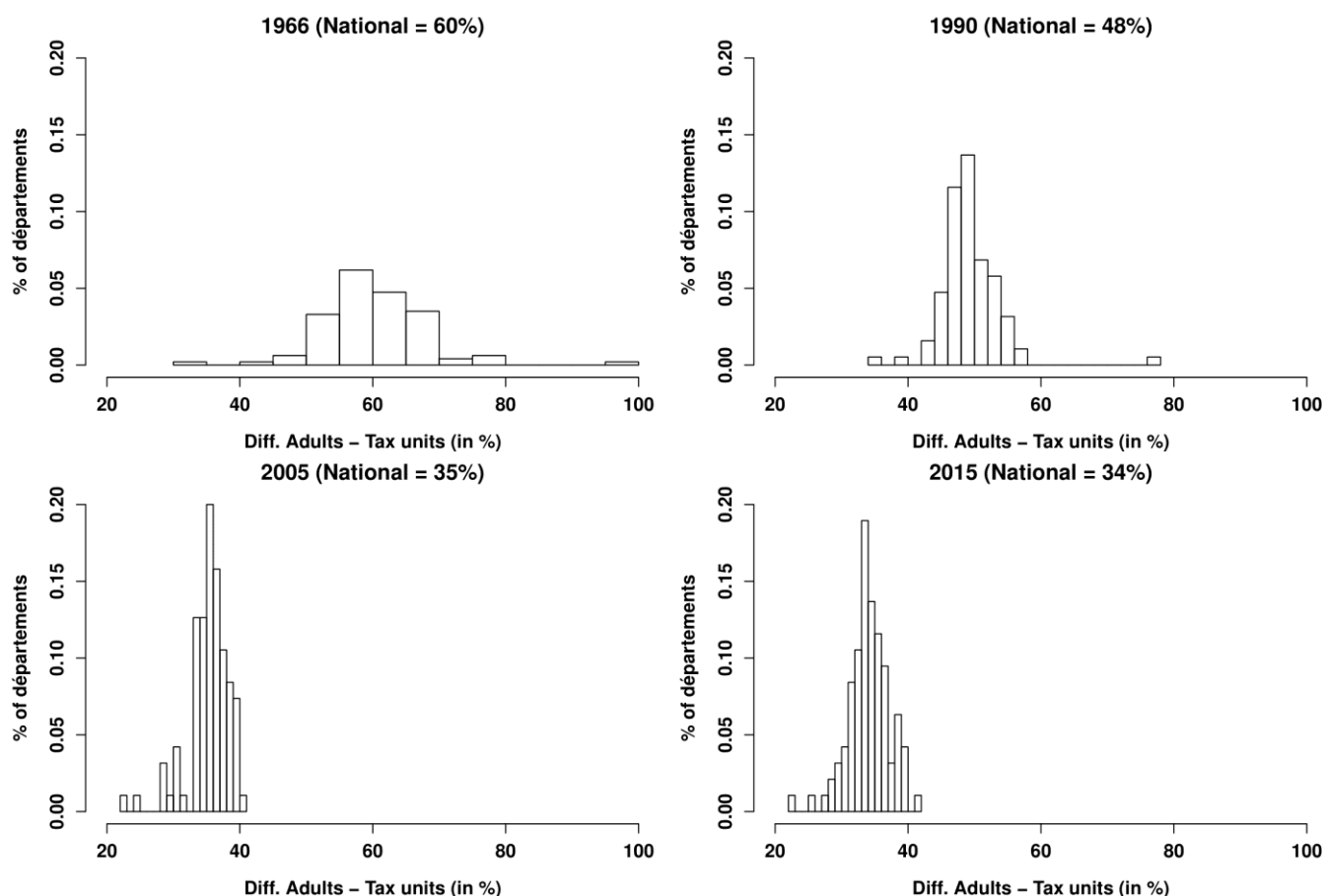
Note: We express the difference between the number of adults and the number of tax units as a percentage of the number of tax units. Departmental distribution for 95 geographical units.

The French administration did not publish these fiscal tabulations. However, they did keep them in their archives. We hope they will find missing years in the future. Even if we do not get the departmental fiscal tabulations for the above-mentioned years, income tax statistics exist in official publications. In a companion paper (Bonnet et al., 2021), we have collected the total number of tax units subject to income tax, the imposable income declared by these taxable tax units, and the total amount of tax paid, for each year and each department during the period 1922-2015. With these statistics and the age structures of the departmental populations computed by Bonnet (2020), we calibrated an econometric model over the years 1960-69 and 1986-2015. This model allows us to precisely estimate fiscal income per adult. We

use this model to estimate the total fiscal income for each department for the years 1922-59, 1970-85, and 1999, and finally the fiscal income per capita or per adult. These data are available for three geographical levels, consistent with this article.

Figure 10 shows the trends in the relative fiscal income per adult for the departments of four regions (NUTS 1): Centre-Val de Loire, Bretagne, Normandy and Hauts-de-France. In each quadrant, the departments belonging to the region are presented (ranked by colour according to the value in 2018), as well as the region (in black dashed lines). The years 1970-85 and 1999-2000 are not available.

Figure 10: Trends in fiscal income per adult
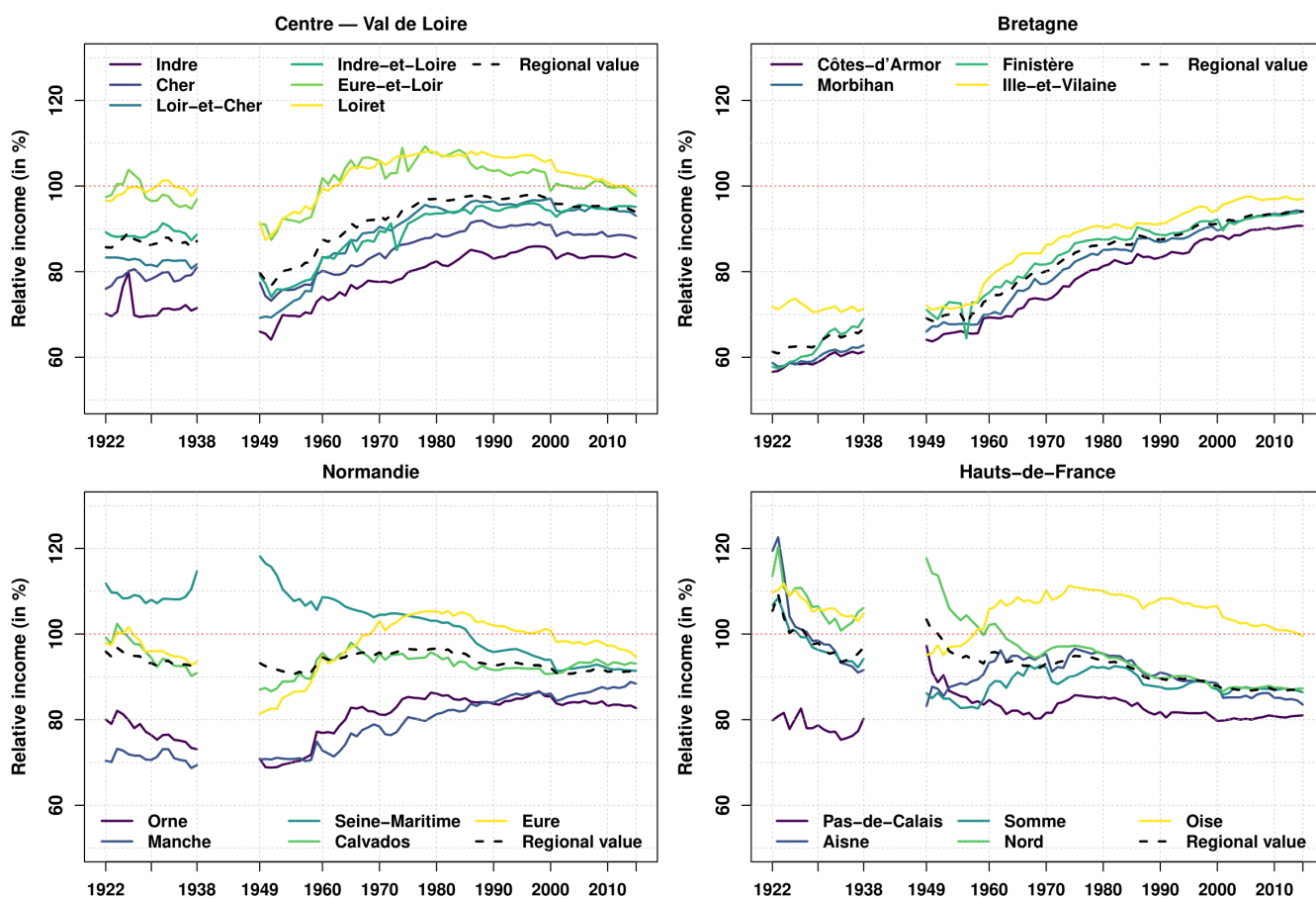
Note: We compute fiscal income per adult by dividing the departmental total income by the number of adults. We express values as a percentage of the national average. We rank departments in each region according to their value in 2015.

The region Centre-Val de Loire experienced a strong catch-up after the war. From the 1960s onwards, income per adult was 10% higher than the national average in Eure-et-Loir and Loiret. It has been the opposite since the 1990s: the region's income per adult reached a maximum before declining slightly. We observe a similar process in Eure and Oise, which borders the Parisian region. Departments in Normandy show very heterogeneous trends, which has led to an intra-regional convergence since the end of the Second World War.

5 Conclusion

In this paper, we reconstruct the income distribution of each French metropolitan department between 1960 and 1969 and from 1986 to 2018. We use new French regional fiscal tabulations that we have uncovered and digitised. We also propose a new methodology to estimate regional income distribution using fiscal tabulations.

This paper gives avenues for future research. A companion paper uses our newly created database to present and explain the evolution of spatial inequality in France. We also plan to extend this methodological paper to produce departmental income series per adult. Our database will be freely available online on two websites[13] and is part of two bigger projects (WID, World Inequality Database; and FRD, French Regional Database) that aim to enhance our knowledge on inequalities and territories.

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[13] https://wid.world/ and https://frdata.org/en/

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Appendix

Figure A1: Classification of geographical units used in the database (NUTS 1 & 2)

NUTS 1 (white numbers, by color)
1 - Ile-de-France
2 - Centre Val-de-Loire
3 - Bourgogne - Franche-Comté
4 - Normandie
5 - Hauts-de-France
6 - Grand-Est
7 - Pays-de-la-Loire
8 - Bretagne
9 - Nouvelle Aquitaine
10 - Occitanie
11 - Auvergne - Rhone-Alpes
12 - Provence-Alpes-Côte d'Azur
13 - Corse

NUTS 2 (black numbers)
1 - Ile-de-France
2 - Centre - Val de Loire
3 - Bourgogne
4 - Franche-Comté
5 - Basse-Normandie
6 - Haute-Normandie
7 - Nord-Pas de Calais
8 - Picardie
9 - Alsace
10 - Champagne-Ardenne
11 - Lorraine
12 - Pays de la Loire
13 - Bretagne
14 - Aquitaine
15 - Limousin
16 - Poitou-Charentes
17 - Languedoc-Roussillon
18 - Midi-Pyrénées
19 - Auvergne
20 - Rhône-Alpes
21 - Provence-Alpes-Côte d'Azur
22 - Corse

Note: New regions used in the database (NUTS 1) presented by color with associated numbers in white. Regions which existed between 1970 and 2015 (NUTS 2) delimited by the black lines with associated numbers in black.

Figure A2: Classification of geographical units used in the database (NUTS 3)

1966 and after

Before 1966

NUTS 3
1 - Ain
2 - Aisne
3 - Allier
4 - Alpes-de-Haute-Provence
5 - Hautes-Alpes
6 - Alpes-Maritimes
7 - Ardèche
8 - Ardennes
9 - Ariège
10 - Aube
11 - Aude
12 - Aveyron

13 - Bouches-du-Rhône
14 - Calvados
15 - Cantal
16 - Charente
17 - Charente-Maritime
18 - Cher
19 - Corrèze
20 - Corse
21 - Côte-d'Or
22 - Côtes-d'Armor
23 - Creuse
24 - Dordogne
25 - Doubs
26 - Drôme
27 - Eure
28 - Eure-et-Loir
29 - Finistère

30 - Gard
31 - Haute-Garonne
32 - Gers
33 - Gironde
34 - Hérault
35 - Ille-et-Vilaine
36 - Indre
37 - Indre-et-Loire
38 - Isère
39 - Jura
40 - Landes
41 - Loir-et-Cher
42 - Loire
43 - Haute-Loire
44 - Loire-Atlantique
45 - Loiret
46 - Lot

46 - Lot
47 - Lot-et-Garonne
48 - Lozère
49 - Maine-et-Loire
50 - Manche
51 - Marne
52 - Haute-Marne
53 - Mayenne
54 - Meurthe-et-Moselle
55 - Meuse
56 - Morbihan
57 - Moselle
58 - Nièvre
59 - Nord

60 - Oise
61 - Orne
62 - Pas-de-Calais
63 - Puy-de-Dôme
64 - Pyrénées-Atlantiques
65 - Hautes-Pyrénées
66 - Pyrénées-Orientales
67 - Bas-Rhin
68 - Haut-Rhin
69 - Rhône
70 - Haute-Saône
71 - Saône-et-Loire
72 - Sarthe
73 - Savoie

74 - Haute-Savoie
75 - Seine
76 - Seine-Maritime
77 - Seine-et-Marne
78 - Seine-et-Oise
79 - Deux-Sèvres
80 - Somme
81 - Tarn
82 - Tarn-et-Garonne
83 - Var
84 - Vaucluse
85 - Vendée
86 - Vienne
87 - Haute-Vienne
88 - Vosges
89 - Yonne
90 - Territoire de Belfort
91 - Essonne
92 - Hauts-de-Seine
93 - Seine-Saint-Denis
94 - Val-de-Marne
95 - Val-d'Oise
96 - Paris
97 - Yvelines

Note: Departments used in the database (NUTS 3). Change of nomenclature used in Ile-de-France presented on the top right.